

Research Note

Scanning Electron Microscopy of *Geopetitia aspiculata*
(Nematoda: Spirurida): Identifying Morphologic Features of the
Mature Male

R. A. FRENCH,¹ K. S. TODD,¹ T. P. MEEHAN,² AND J. F. ZACHARY¹

¹ University of Illinois, College of Veterinary Medicine, Urbana, Illinois 61801, e-mail: r-french@uxa.sco.uiuc.edu and

² Brookfield Zoological Park, 3300 Golf Road, Brookfield, Illinois 60513

ABSTRACT: *Geopetitia* spp. (Nematoda: Spirurida) are classified by the morphology of the spicules and number and distribution of genital papillae of the male. The genital papillae of the adult male *Geopetitia aspiculata* were studied with the aid of scanning electron microscopy and compared to that reported in the literature. The parasites were collected from infected birds at the Lincoln Park Zoological Gardens, Chicago, and from experimentally infected zebra finches (*Taeniopygia guttata*). The absence of spicules and the number and distribution of papillae on the ventral aspect of the posterior extremity are generally consistent with those previously reported for *Geopetitia aspiculata*. Eight pair of caudal papillae and a pair of small, lateral, subterminal papillae (phasmids) were present. No papilla was observed on the anterior portion of the circumanal cuticular inflation nor was a double subterminal papilla present.

KEY WORDS: avian, *Geopetitia aspiculata*, morphology, nematode, parasite, SEM observations, Tetrameridae.

Geopetitia spp. (Tetrameridae: Geopetitiinae) are nematodes of birds (Webster, 1971; Chabaud, 1975). The genus was first described by Chabaud in 1951, and 8 species have been documented (Webster, 1971). *Geopetitia* spp. (but not *G. aspiculata*) have been reported in wild birds (Webster, 1971; Bartlett et al., 1984). Only birds in captivity have been reported to be infected with *G. aspiculata*. The natural source of parasites in captive birds is unknown. Cases have been reported only in North America at the National Zoological Park, Washington, D.C. (Webster, 1971), the Assiniboine Park Zoo, Winnipeg, Canada (Bartlett et al., 1984), and the Lincoln Park Zoological Gardens, Chicago (French et al., 1994). Barus (1968, 1971) described what he considered to be *G. aspiculata* in wild birds in Cuba; however, Barus (1968) indicated spicules were present in the male. Webster (1971) stated that it is the absence of spicules in *G. aspiculata* that readily distinguishes this species from others in the genus. Barus (1971) did not describe or give data on spicules in his second report but did

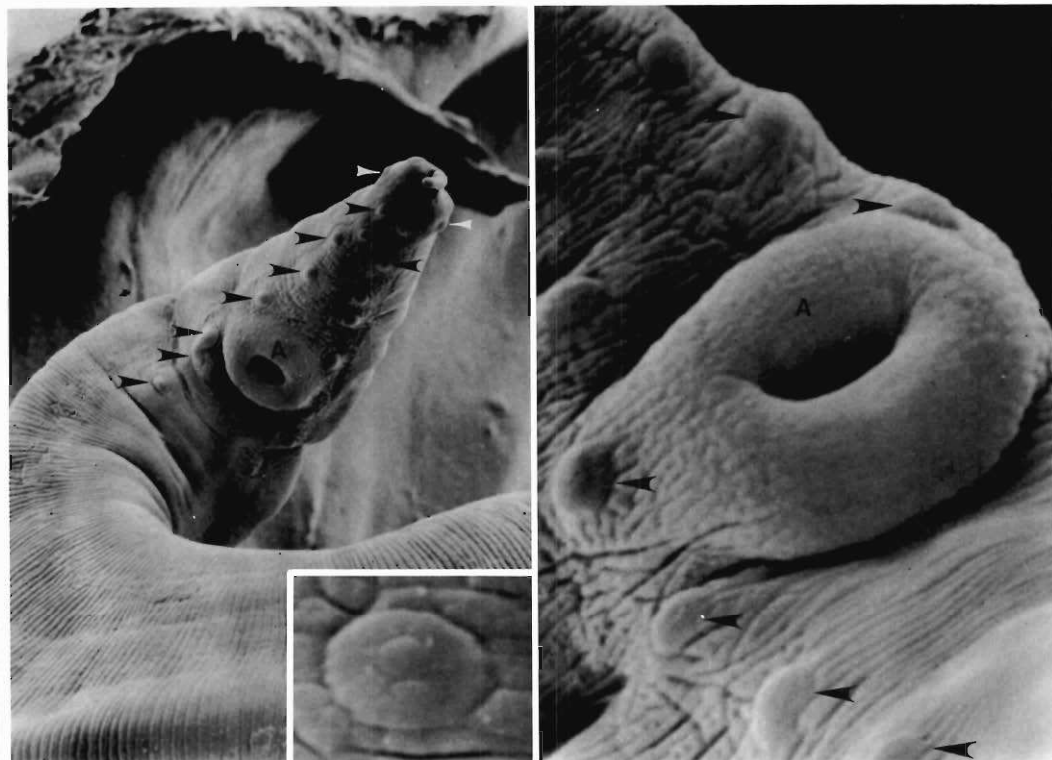
include them in illustrations. It can be assumed the species described by Barus do not include *G. aspiculata*, although this has not been confirmed by reevaluation of specimens (Webster, 1971).

Identification of *Geopetitia* spp. is usually based on morphologic examination of the spicules and the number and distribution of genital papillae of the male (Webster, 1971). Females have no characteristics useful for specific differentiation of *Geopetitia* spp. (Webster, 1971; Chabaud, 1975). However, Mawson (1966) did use morphology of pseudolabia and relative position of the vulva and anus in female specimens, since no males were available, to differentiate *G. falco* and *G. chibiae*.

There are no demonstrated spicules in male *G. aspiculata* (Webster, 1971). The number and distribution of the genital papillae in the male have been described and illustrated by Webster (1971) and Bartlett et al. (1984). In Webster's (1971) description and diagrammatic illustration of genital papillae, 3 sublateral preanal pairs, 1 adanal pair, 4 postanal pairs, 1 double subterminal papilla, 1 papilla on the anterior anal lip, and subterminal phasmids were present. Bartlett et al. (1984) described and illustrated a papilla-like swelling immediately anterior to the anus and 8 pairs of caudal papillae.

The present study utilizes scanning electron microscopy (SEM) to document the morphologic features of the male used in the identification of *G. aspiculata*. The identification was confirmed as *Geopetitia* sp., "probably *G. aspiculata*" by Dr. J. Ralph Lichtenfels (USDA-ARS, National Parasite Collection, No. 69974, 27 December 1984, specimens from an orange quit, *Euneornis campestris*).

Nematode specimens of *G. aspiculata* ($n = 6$ male) were collected from naturally infected birds at the Lincoln Park Zoological Gardens, Chicago (French et al., 1994). Infected birds included 1 silver-throated tanager, *Tangara icterocephala*;



Figures 1, 2. *Geopetitia aspiculata*. 1. SEM of the posterior end of a mature male *Geopetitia aspiculata* from *Taeniopygia guttata*. Note the number (8) and orientation (3 pairs preanal and 5 pairs postanal) of genital papillae (black arrowheads), the lateral subterminal phasmids (white arrowheads), and the prominent circumanal cuticular inflation (A = anus). $\times 1,400$. Inset: High magnification of the genital papillae on the male. Note the slightly raised nipplelike structure. $\times 5,900$. 2. Higher magnification of the circumanal cuticular inflation on the male (A = anus, genital papillae [arrowheads]). The scanning electron micrograph is oriented posterior (upper left) to anterior (lower right). Note the absence of the papilla described in the literature on the anterior aspect of the cuticular inflation. Spicules are not present. $\times 3,560$.

2 Harris's sparrows, *Zonotrichia querula*; 2 white-spectacled bulbuls, *Pycnonotus xanthopygos*; 1 white-crested laughingthrush, *Garrulax leucolophus*; and 1 orange quit, *Euneornis campestris*. In addition, specimens ($n = 5$ male) were collected from experimentally infected zebra finches, *Taeniopygia guttata* (French et al., 1994).

Nematode parasites were removed from birds by sharp dissection. A pepsin digest of the parasite-tissue mass was performed to aid in the dissection of the encapsulated, tightly coiled parasites (French et al., 1994). The nematodes recovered from digestion were fixed in 2.5% phosphate-buffered glutaraldehyde for SEM. Specimens were dehydrated in standard dilutions of ethanol, critical point-dried in CO_2 , mounted on aluminum stubs, sputter-coated with a thin layer of gold, and examined with an ISI-WB-6 scanning electron microscope.

Light microscopic examination and measurements of sexually mature nematodes recovered from experimentally infected zebra finches have been previously described (Bartlett et al., 1984; French et al., 1994). The posterior extremity of the male was ventrally coiled, spiraled, and difficult to evaluate by SEM. Eight pairs of caudal papillae were present, 3 preanal pairs and 5 postanal approximately equidistant to the tip of the tail (Fig. 1). Some disparity was noted in the location of papillae from sample to sample. There would be misalignment of pairs of papillae and papillae would be situated such that an adanal pair would be identified on some specimens. The number of papillae (8 pairs) was always consistent. Papillae were round and slightly raised with a central, smaller, round protuberance (Fig. 1, inset). A pair of subterminal, small, stalklike papillary structures were present on the lateral

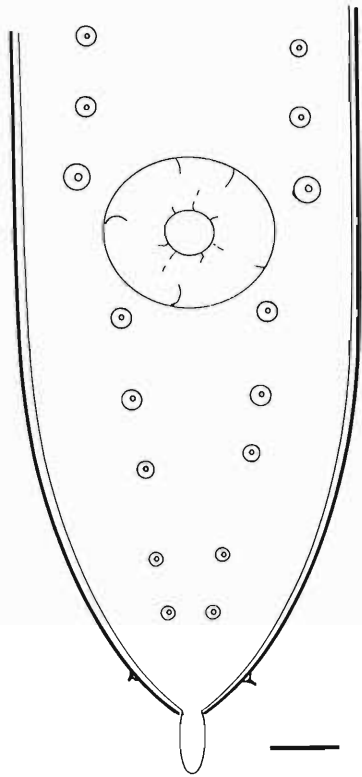


Figure 3. *Geopetitia aspiculata*: Illustration of the ventral view of the posterior end of a mature male. There are 8 pairs of sublateral genital papillae, 1 pair of subterminal phasmids on the lateral line, and a circumanal cuticular inflation, and no spicules are present. Scale bar = 10 μ m.

aspect of the tail tip. These structures, identified as phasmids by Webster (1971), were not always visible due to inversion of the stalklike structure, thus creating a pit or inpouching. Spicules were absent. The anus was bounded circumferentially by a prominent cuticular inflation (Fig. 2). No papilla was identified on the anterior portion of the circumanal cuticular inflation in all specimens examined. The findings are summarized by illustration in Figure 3.

The nematodes recovered from birds at the Lincoln Park Zoological Gardens and used for the experimental infections were considered to be *Geopetitia aspiculata* based on morphology and previous descriptions (Webster, 1971; Bartlett et al., 1984; French et al., 1994). The lack of spicules in the males and arrangement of posterior papillae were consistent with Webster's and Bartlett's findings with the exception of the identification of a papilla anterior to the circumanal

inflation (Webster, 1971) and a "papillae-like" swelling present immediately anterior to the anus (Bartlett et al., 1984). The single papilla anterior to the anus was not identified by light microscopy (French et al., 1994) or SEM in nematodes recovered from zoo specimens or experimentally infected birds. Webster (1971) also described and illustrated a double subterminal papilla that was not observed by either SEM or light microscopy in the present study and was not described by Bartlett et al. (1984). However, in general, the number of genital papillae and general distribution was constant. There are descriptive and illustrated differences in the location of the genital papillae of the male, that is, whether papillae were preanal, adanal, or postanal (Webster, 1971; Bartlett et al., 1984; French et al., 1994). The disparity was also observed by SEM. The papillae, though pedunculated in appearance with light microscopy, were morphologically nipplelike with a central protuberance. The phasmids were not described by Bartlett et al. (1984) but are difficult to see with light microscopy.

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